



EARLY WEANING FROM INVASIVE PRESSURE VENTILATION AMONG CRITICALLY ILL PATIENTS

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ABSTRACT

Purpose: To review the studies comparing outcomes with early weaning from the IPV among critically ill patients. **Results:** 11 of the studies were randomized controlled trials, 8 were nonrandomized controlled trials and 7 were cohort studies. 16 of these studies concluded that early weaning decreases the duration of IPV, length of stay, morbidity, and mortality in the intensive care units ($p < 0.05$). 10 of the studies showed significant differences using sedation vacation, spontaneous breathing trials, spontaneous awakening trials, and mobilization while on IPV. **Conclusion:** Best practices in early weaning include a sedation vacation, spontaneous breathing trials, spontaneous awakening trials, mobilization and respiratory management.

KEYWORDS: Invasive pressure ventilation, early weaning, nurses, intensive care unit, critically ill patients, clinical practice.

INTRODUCTION:

Invasive pressure ventilation (IPV) is a lifesaving intervention in the care of critically ill patients with pneumonia, acute lung injury, neurologic emergencies, cardiopulmonary arrest (Mehta S, Burry L, Cook D, et al. 2012). Early weaning from the IPV reduces the incidence and prevalence of complications like barotraumas, ventilator-associated pneumonia (VAP), length of stay (LOS) and total expenses in the intensive care unit (Klompas M, Branson R, Eichenwald EC, et al., 2014; Balas MC, Vasilevskis EE, Olsen KM, et al. 2014), stress ulcer, gastrointestinal bleeding. Weaning is a major challenge among the critical care nurse. There is a need for safe early weaning for critical care nurses to provide high-quality standards of care with the use of advanced technology (Fan L, Su Y, Elmadhoun OA, et al. 2015).

Mechanical ventilators (MV) is used among critically ill patients for managing ventilation, gas exchange capabilities, acute respiratory failure and when the respiratory drive is incapable of initiating ventilator activity (MacIntyre, N. R. 2012; Haas, C. F., & Bauser, K. A. 2012). Weaning from the MV is a process of gradual or sudden ventilator support withdrawal in critically ill patients (Frutos-Vivar, F., & Esteban, A. 2013). Evidence-based guidelines on the ventilator discontinuation process for timely weaning and use of spontaneous breathing trials (SBTs) (Rose et al., 2015, McConville & Kress 2013; Peñuelas, Ó., Thille, A. W., & Esteban, A. 2015). This review explores the clinical outcomes for early weaning in invasive pressure ventilation among critically ill patients.

MATERIALS AND METHODS:

Search engines of Pubmed, CINAHL, Cochrane library using keywords mechanical ventilation, invasive pressure ventilation, early weaning, physicians, respiratory therapists, nurses, critically ill patients, ICU, clinical practice, evidence-based practice without date limitation were used. 78 articles were identified during our literature search, excluding duplicated articles selected from different search engines. Finally, 26 relevant studies were included in the review.

Results

11 of the studies were randomized controlled trials, 8 were nonrandomized controlled trials and 7 were cohort studies. 16 of these studies concluded that early weaning decreases the duration of IPV and length of stay in the intensive care units ($p < 0.05$). 10 of the studies showed significant differences using sedation vacation, spontaneous breathing trials, spontaneous awakening trials, and mobilization while on IPV.

Three studies showed that early weaning was associated with significant changes ($P < 0.01$) in tidal volume, PEEP, respiratory rate, oxygen administration, head-of-bed elevation, reduction in mortality from 54.8% to 39.5% ($P < 0.01$) (Fuller, B. M., Ferguson, I. T., Mohr, N. M., Drewry, A. M., Palmer, C., Wessman, B. T., ... & Kolomiets, A. A. 2017; Dries, D. J., McGonigal, M. D., Malian, M. S., Bor, B. J., & Sullivan, C. 2004). Two studies showed that the first SBT to occur was significantly shorter during the intervention period (49.9 ± 63.2 hours vs 72.5 ± 86.9 , $p < 0.18$), shorter LOS in the ICU ($P < 0.018$) compared with the control period with IPV (Iregui, M., Ward, S., Clinikscale, D., Clayton, D., & Kollef, M. H. 2002; Tanios, M. A., Nevins, M. L., Hendra, K. P., Cardinal, P., Allan, J. E., Naumova, E. N., & Epstein, S. K. 2006).

Weaning was significantly associated with a decrease of incidence of VAP ($p < 0.01$) and independently associated with a lower incidence of VAP in three

studies (95% confidence interval, 0.62 - 0.95, $P < 0.03$) (Quenot, J. P., Ladoire, S., Devoucoux, F., Doise, J. M., Cailliod, R., Cunin, N., ... & Charles, P. E. 2007; Arias-Rivera, S., del Mar Sánchez-Sánchez, M., Santos-Díaz, R., Gallardo-Murillo, J., Sánchez-Izquierdo, R., Frutos-Vivar, F., ... & Esteban, A. 2008; Navalesi, P., Frigerio, P., Moretti, M. P., Sommariva, M., Vesconi, S., Baiardi, P., & Levati, A. 2008). The frequency with which patients who passed the daily screen underwent spontaneous breathing trials (SBTs) increased throughout the weaning process in 3 studies ($P < 0.001$). SBTs was considered once patients had passed a DS ($P < 0.001$) and physicians ordered more SBTs (46 vs 65%, $P < 0.004$) (Bosma, K. J., Read, B. A., Nikoo, B., Mohammad, J., Jones, P. M., Priestap, F. A., & Lewis, J. F. 2016; Girard, T. D., Kress, J. P., Fuchs, B. D., Thomason, J. W., Schweickert, W. D., Pun, B. T., ... & Jackson, J. C. 2008).

The intervention group displayed a significantly shorter median weaning time than the control group in 3 studies (2 vs 5 days, $p < 0.05$) (Kress, J. P., Pohlman, A. S., O'Connor, M. F., & Hall, J. B. 2000; Marelich, G. P., Murin, S., Battistella, F., Inciardi, J., Vierra, T., & Roby, M. 2000). Three studies discussed the significant increases in spontaneous awakening trials (SATs) and percentage of SBTs performed without sedation were mirrored by significant decreases in duration of MV and ventilator-associated events (OR 0.63) and infection-related ventilator-associated complications (OR 0.35) (Girard TD, Kress JP, Fuchs BD, et al. 2008; Mehta S, Burry L, Cook D, et al. 2012; Fan L, Su Y, Elmadhoun OA, et al. 2015). Patients managed with awakening and breathing coordination and early exercise/mobility bundle experienced a near halving of the odds of delirium (OR 0.55, $p < 0.03$) and increased odds of mobilizing out of bed at least once during an ICU stay in 3 studies (OR 2.11, $p < 0.003$) (Stollings JL, Foss JJ, Ely EW, et al. 2015; Klompas M, Anderson D, Trick W, et al. 2015; Klompas M, Anderson D, Trick W, et al. 2015). The median duration of MV was 4.9 days in the IG, as compared with 7.3 days in the control group ($p < 0.004$) in 3 studies (Tanios M, de Wit M, Epstein S, et al. 2009).

DISCUSSION:

Studies have shown that implementing early weaning is associated with improved clinical outcomes (tidal volume, respiratory rate, oxygen administration, and head-of-bed elevation, lung-protective ventilation). Early weaning had led to reductions in the duration of IPV, reduction in more than one course of MV, length of stay (LOS), decrease mortality, and hospital costs. Early weaning from invasive pressure ventilation was successful to wean patients from IPV more efficiently using first spontaneous breathing trial (SBT) and reducing.

Ventilator mechanical protective was effective in reducing the duration of IPV support without any adverse effects. Weaning and sedation protocols of IPV and ventilator-associated pneumonia (VAP) had successful extubation, reduced complications, shorter ICU stays and decrease use of ventilator days/ICU day's ratio. Daily screening of the respiratory function of adults receiving MV, and SBT in appropriate patients and physician's decision, respiratory therapists, and nurses to identify spontaneous breathing and tests followed by 2-hour SBT when the SBT was successful, reduced the duration of MV and the cost of intensive care and was associated with fewer complications.

Early weaning protocols (progressive decreases in the level of assistance as tolerated with daily assessment for SBT) utilized were safe and feasible for guiding weaning from MV on proportional assist ventilation (PAV) was better than PSV.

A wake-up and breathe protocol that pairs daily spontaneous awakening trials (interruption of sedatives) with daily SBT results in early discharge from intensive care and hospital and lesser reintubation) for MV patients in ICU than current standards approach. Staged weaning (daily screen with SBTs and physician prompt) using periodic reinforcement in invasive pressure ventilation without daily supervision from a weaning physician or team and improved compliance in early weaning outcomes.

Critically ill patients managed with the awakening and breathing coordination, delirium monitoring/management and early exercise/mobility bundle spent 3 more days breathing without assistance, experienced less delirium, and were more likely to be mobilized during their ICU stay than patients treated with usual care. Patients managed with sedation protocol and a daily sedation interruption did not have any significant differences in the duration of MV or LOS. Patients in the protocol-directed sedation group had a significantly lower tracheostomy rate compared with patients in the non-protocol group ($P < 0.038$) had shorter durations of MV, LOS, and hospital ($P < 0.001$). Significant increases in the performance of SATs and SBTs, there were significant decreases in ventilator-associated events, duration of MV and LOS. Use of nurse-implemented protocol NIP was significantly associated with a decreased in the incidence of VAP ($P < 0.01$).

CONCLUSIONS:

Early weaning directed bundle care reduces weaning times, duration of MV, LOS in neurological patients, and effects are more significant for conscious patients than in unconscious patients. A daily interruption of sedative drug infusions, paired sedation and weaning protocol of daily SATs and SBTs were better at reducing the length of MV, LOS and one-year mortality in invasive pressure ventilation. Noninvasive positive-pressure ventilation facilitates weaning and supports respiration for early weaning from IPV. Awakening and breathing coordination protocol significantly improved measure compliance, pre-intervention rates of screening, performing and coordinating SAT and SBTs in invasive pressure ventilation.

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